


# HMT-West ([http://hmt.noaa.gov/field\\_programs/hmt-west/](http://hmt.noaa.gov/field_programs/hmt-west/))

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# HMT

## Hydrometeorology Testbed




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### HMT-West Overview

HMT-West is the first regional demonstration of the Hydrometeorology Testbed strategy. It developed as an outgrowth of NOAA's CALJET and PACJET projects (1997-2003), which were aimed at improving short-term forecasting of land-falling storms impacting the west coast of the U.S. Intense precipitation associated with these storms often brings challenges to regional water managers attempting to balance the need for water supply storage and flood mitigation.

[Read more details...](#)

### Field Experiments




 [Go to Current Year Project](#)

### Related Projects

- **CalWater:** Our current understanding of heavy precipitation events and how precipitation will change in a changing climate is hampered by incomplete scientific knowledge. Taking advantage of the infrastructure and knowledge gained through HMT-West, Science leaders from the California Energy Commission, NOAA, and Scripps Institution of Oceanography are identifying gaps, developing strategies, and assisting CEC in planning for a possible follow-up field study.
- **HMT-West Legacy:** An agreement between NOAA and the [California Department of Water Resources](#) has led to the deployment of additional instrumentation across the HMT-West domain for long term monitoring of soil moisture, water vapor, precipitation, and snow level across the state of California. These instruments will be deployed in stages over a period of years beginning in 2009. Over time, these observations will create an important climate record and datasets to verify model QPF and improve overall forecast skill.

NOAA Hydrometeorology Testbed  
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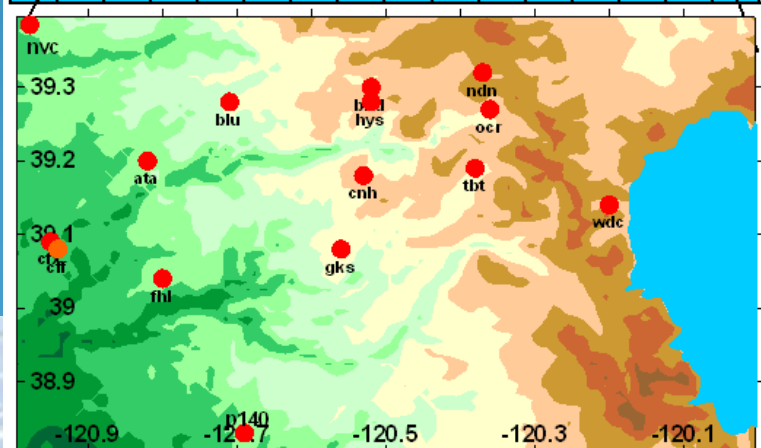
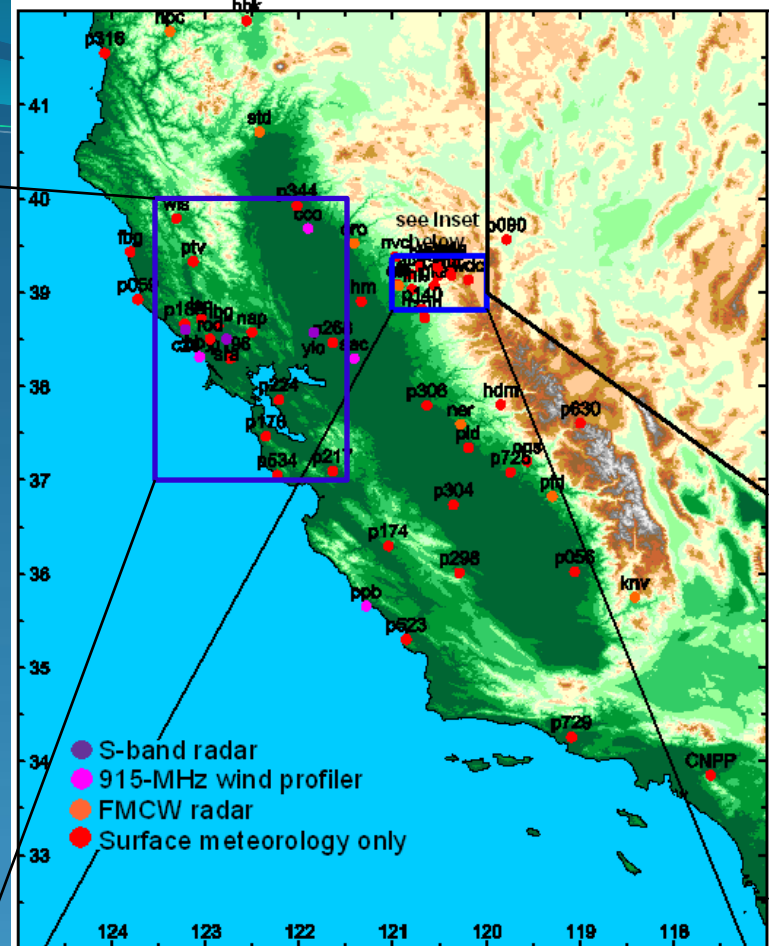
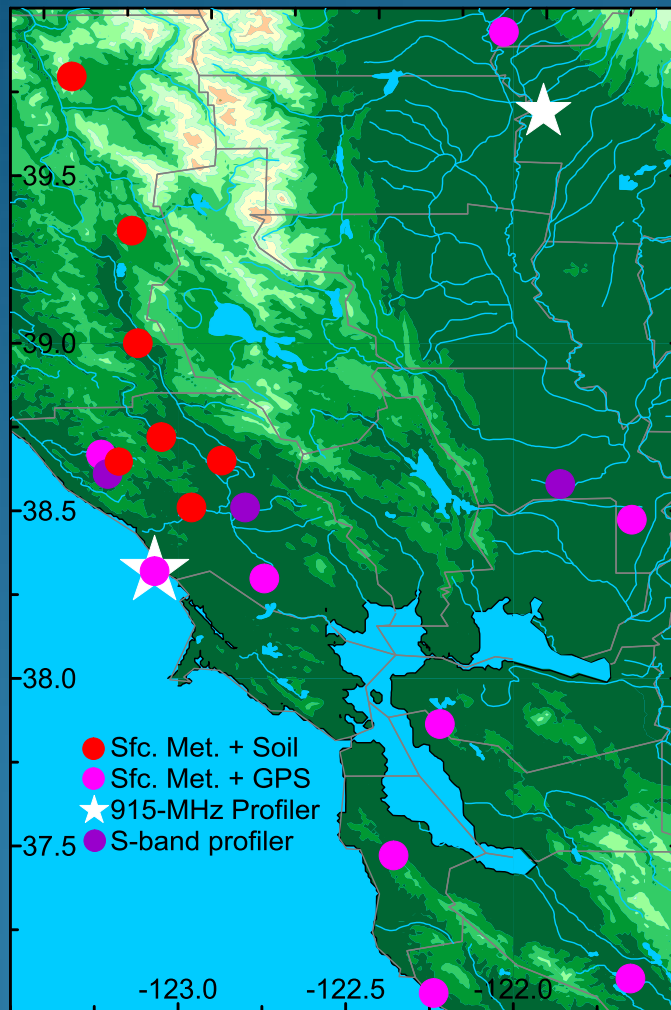


S-band Precipitation Profiler

# HMT-West: FY12 Major Accomplishments

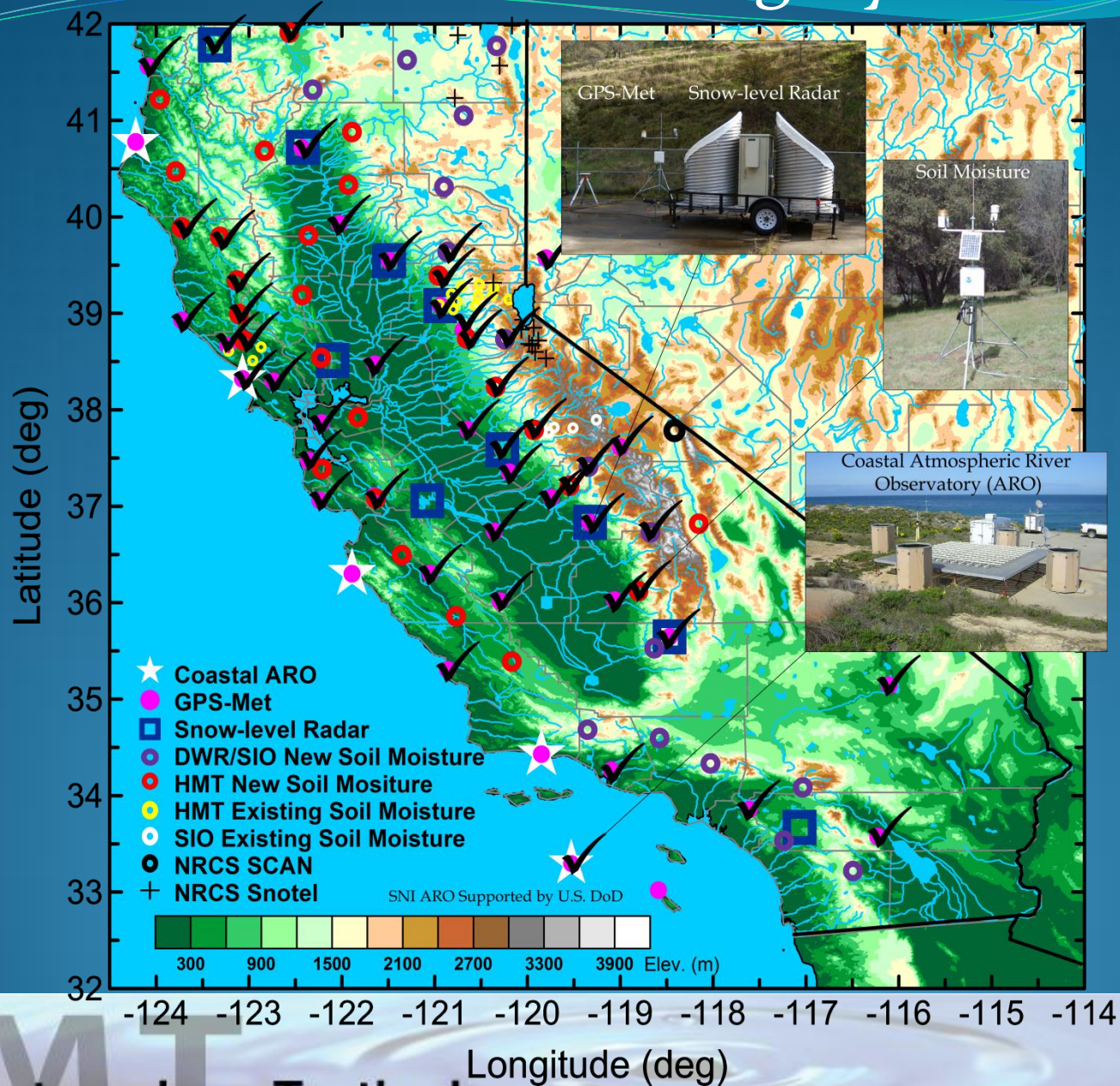
- Continued operation and maintenance of observing networks in American, Russian, and Babocomari River Basins
- Continued implementation of HMT-Legacy observing, modeling, display and decision support projects in CA
- Completed Atmospheric River Retrospective Forecast Experiment with HPC
- Prototyped NEXRAD and KPIX radar looping displays in Google maps
- Delivered SHEF-encoded HMT real-time observations to NWS Western Region (freezing level, accumulated precip, sfc. met.)
- Developed real-time data displays and instrument and data inventory displays in Google maps
- Collected S-PROF, disdrometer, and sfc-met. data to support calibration of KPIX radar in the SCWA project
- Prototyped frost forecast prediction tool for SCWA project
- Developed multi-wind direction displays for the ARO at Westport, WA at the request of Seattle WFO
- Showcased new tools to Western Region
- Publications and Awards

# HMT-West (2011-12)

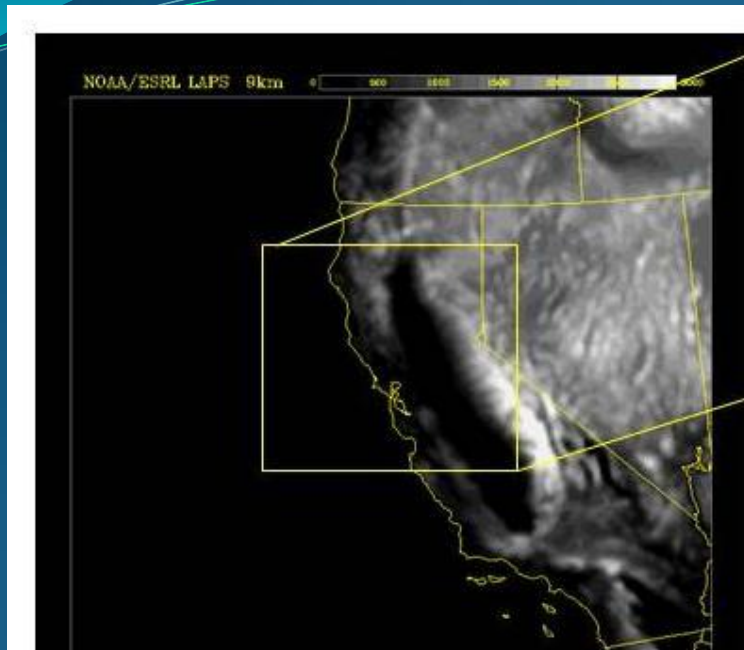




# HMT-West Legacy



# HMT-West Mesoscale Numerical Model



## **Nested domain:**

- Outer/inner nest grid spacing 9 and 3 km, respectively.
- 6-h cycles, 120hr forecasts for the outer nest and 12hr forecasts for the inner nest
- 9 members (listed in the following slide)
- Mixed models, physics & perturbed boundary conditions from NCEP Global Ensemble



# QPF

Example of 24-h QPF  
9-km resolution

9 members:

ARW-TOM-GEP0

ARW-FER-GEP1

ARW-SCH-GEP2

ARW-TOM-GEP3

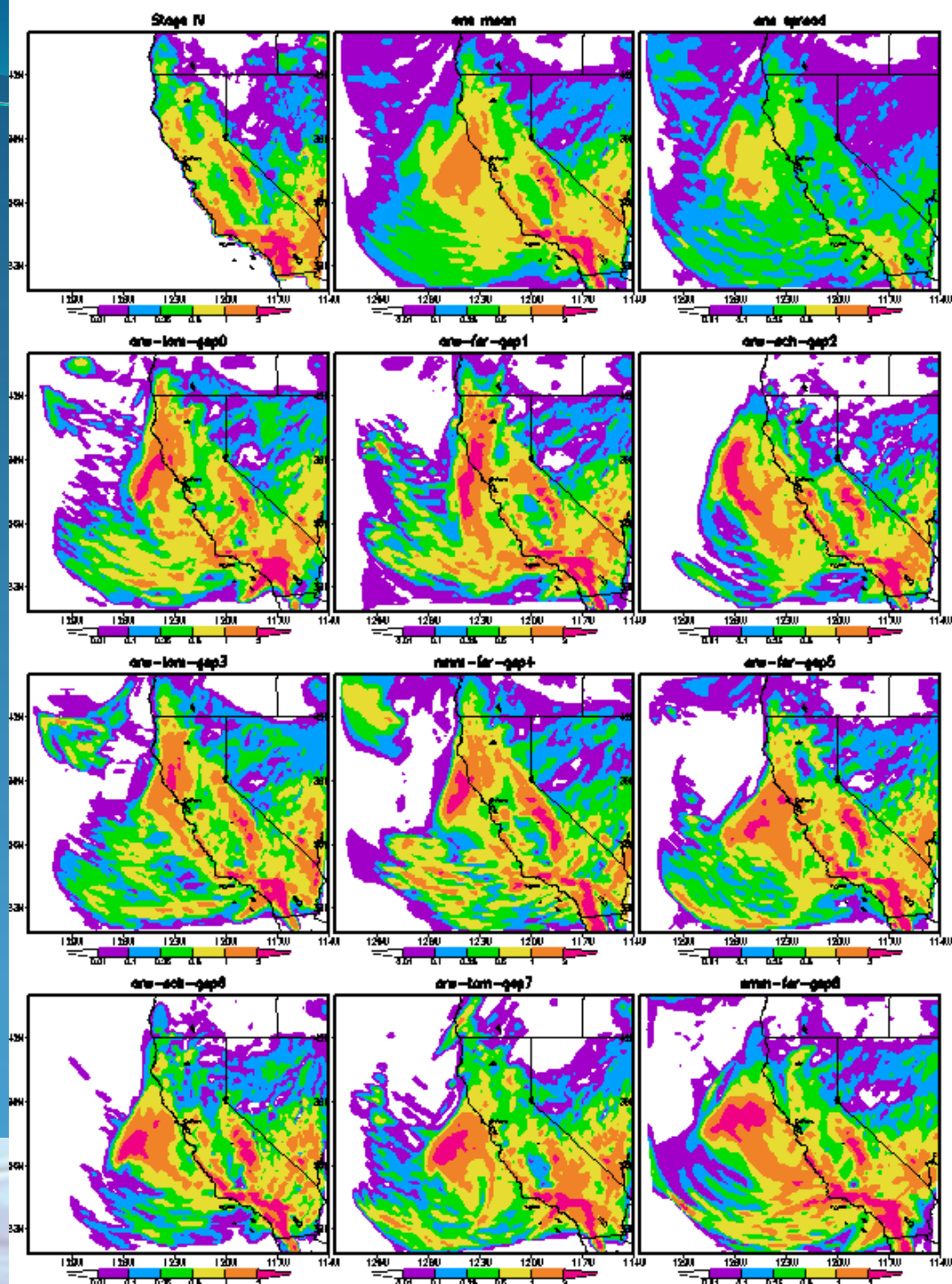
NMM-FER-GEP4

ARW-FER-GEP5

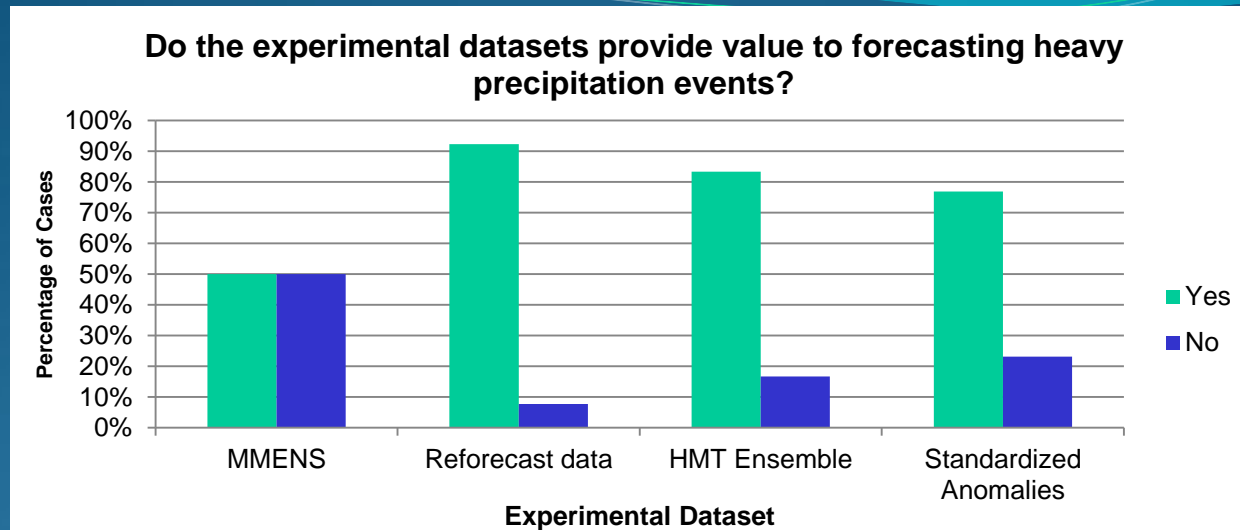
ARW-SCH-GEP6

ARW-TOM-GEP7

NMM-FER-GEP8



# HMT-West ARFEX Experiment Summary



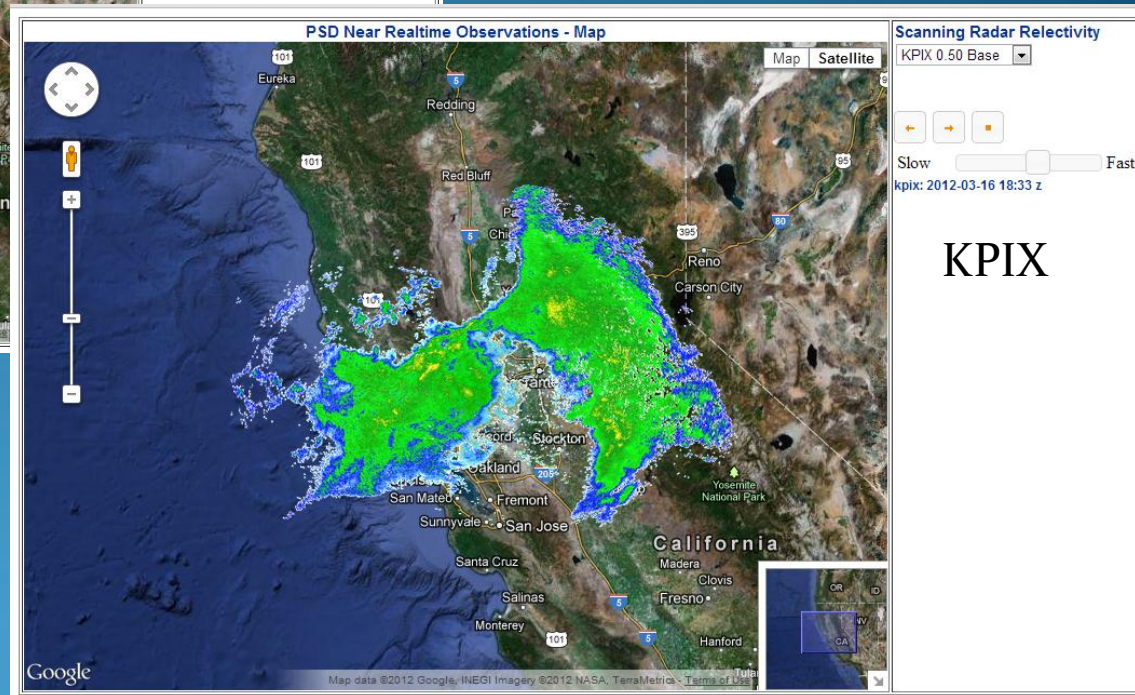
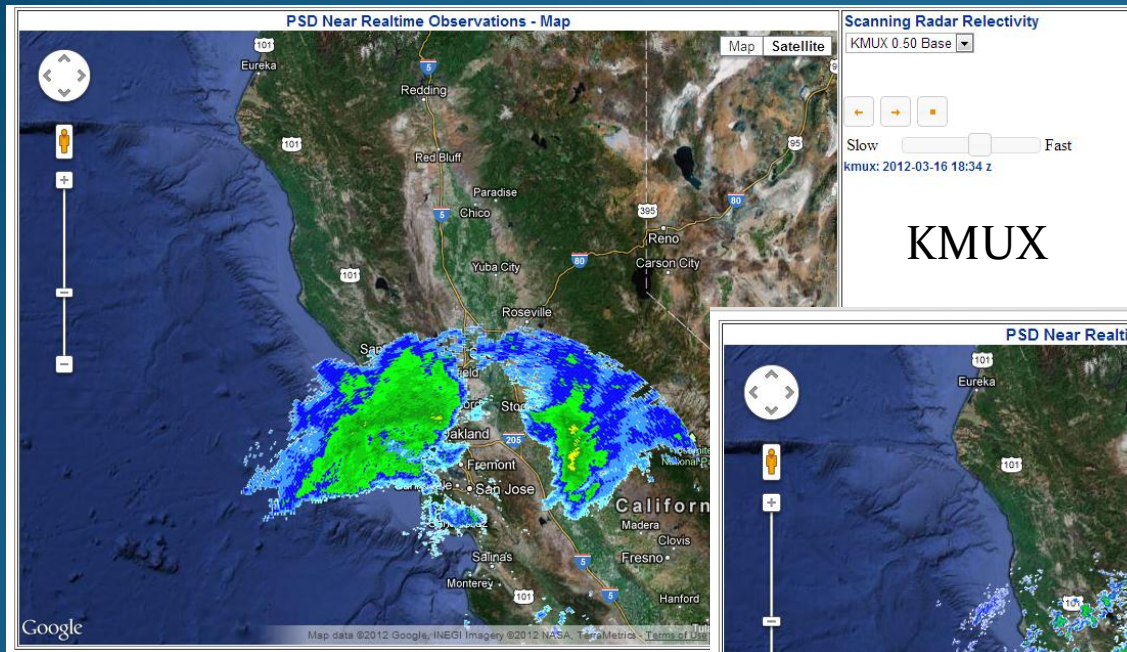
- “Reforecast dataset is very useful.”
- “The best guidance was the reforecast data...this is a big improvement over the raw member forecast...I hope this can be implemented operationally at HPC asap.”
- “Reforecast seems like a very nice way to try and squeeze more utility out of climatological data...I see good performance in the precip patterns... but have no good feel for the magnitude.”
- “...reforecast data seems to miss both the magnitude and distribution in general of the extreme nature of the QPF near the focus (AXIS) of the AR (showing a more dispersed solution)...”
- “The HMT ensemble was about the best in accurately predicting the magnitude and placement of heavy precipitation. The only drawback of this product...is that its domain is too small.”
- “...the HMT...was by far the most superior of the guidance we interrogated during this experiment with high-resolution data over the favored topography.”
- “...HMT ensemble members clustered well, and the maxima were all false alarms.”
- “In particular, the HMT and Reforecast information was very helpful and generally more accurate.”

# HMT-West ARFEX Experiment Summary

- Higher-resolution data is very beneficial, especially in West Coast/terrain driven events
  - Surprised by NAM/HMT performance
- Reforecast (PQPF) and HMT-ensemble data largely considered the best guidance
  - HMT could be *too wet* (?)
  - Resolution of global ensembles a detriment
- PQPF seems to be a worthwhile way to explore extreme QPF at mid-range lead times:
  - “The primary thing the PQPF offers is an enhancement in situation awareness showing the threat for possible heavy precipitation in the medium range time scales.”
  - “Currently, the viability seems limited, but I think the potential is huge and it's absolutely where we need be going with our precipitation forecasting”
- Several participants noted that their time in the experiment was beneficial: *interaction, discussion, training, additional insight, product development, etc....*



# HMT-West Scanning Radar Loops in Google Maps



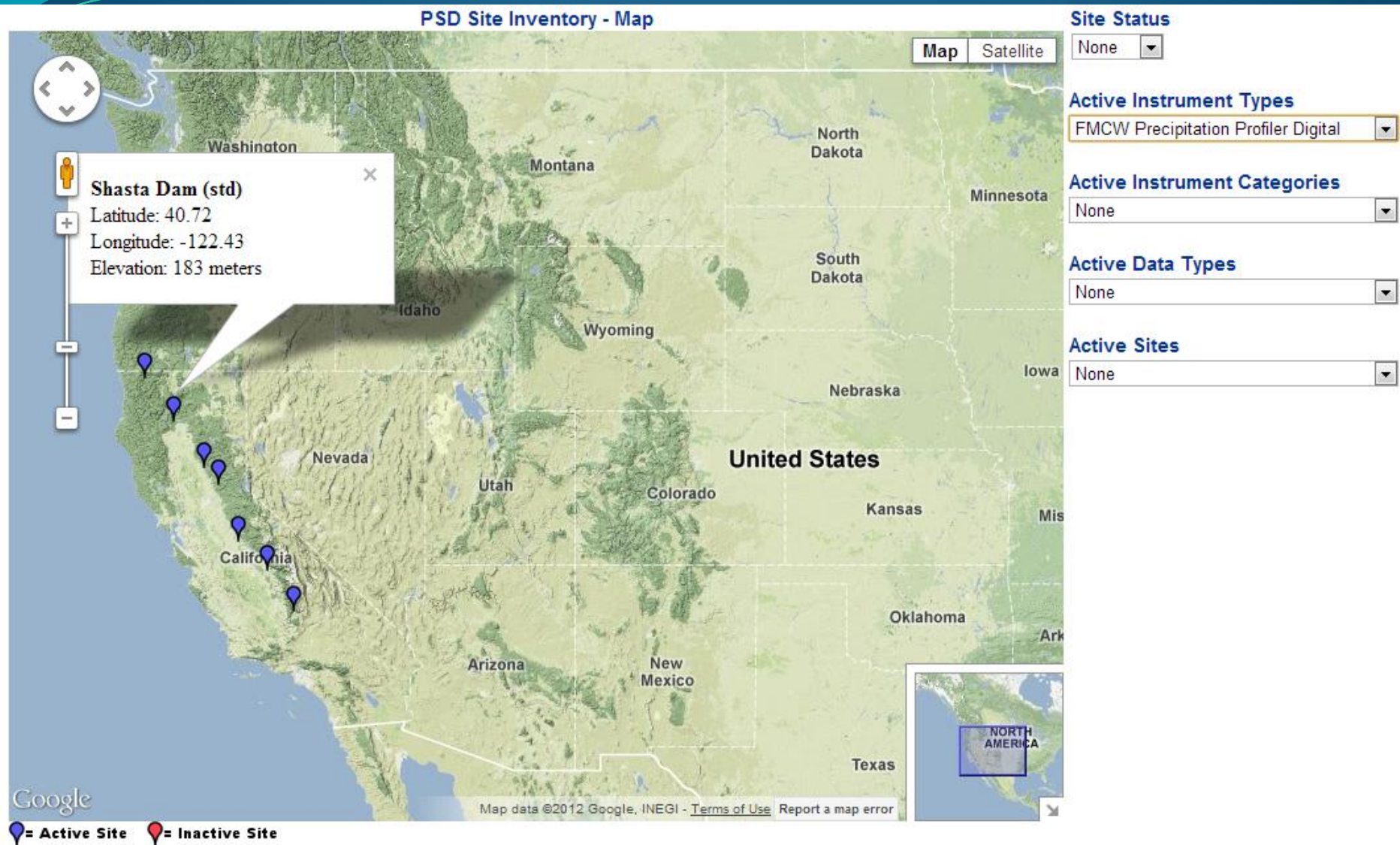


# Data and Instrument Displays in Google Maps





# Data and Instrument Displays in Google Maps



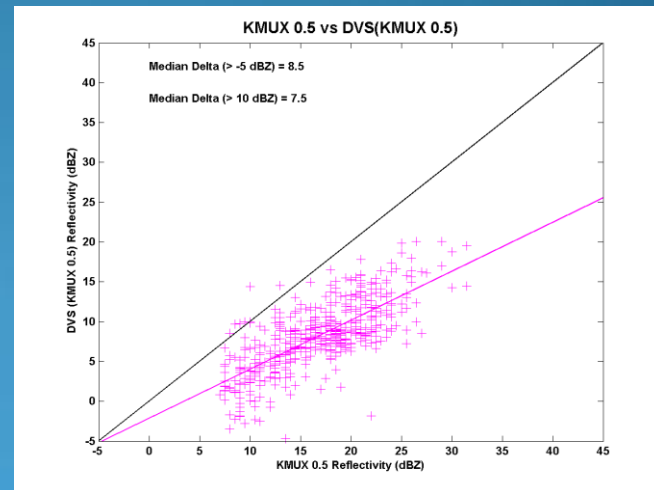
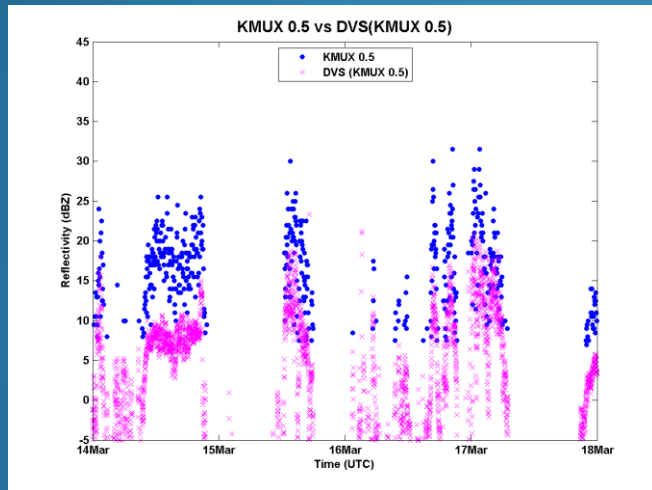


# SCWA QPI Project – Radar Intercomparison Study

Radar	El. Angle	Top of Beam over DVS (km)	Bottom of Beam over DVS (km)	Top of Beam over STR (km)	Bottom of Beam over STR (km)
KPIX	0.5	1.423	0.938	2.165	1.131
KDAX	0.5	0.335	0.036	2.239	0.616
KDAX	0.9	0.461	0.162	2.922	1.299
KDAX	1.3	0.587	0.288	3.604	1.982
KMUX	0.5	5.221	2.599	5.673	2.846

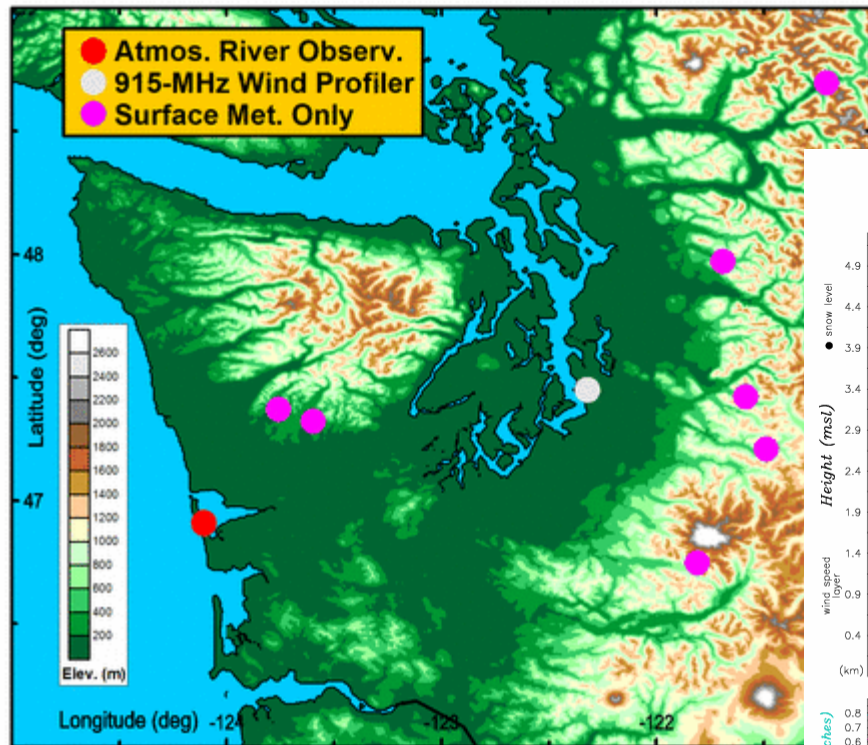
# SCWA QPI Project – Radar Intercomparison Study

- Case study for 14-17 March 2012
- If DVS PARSIVEL (Old) is the reference:
  - DVS SPROF is  $\sim 7.7$  dBZ too LOW
  - KDAX is  $\sim 3.1$  dBZ too LOW (DVS SPROF as intermediate reference)
  - KMUX is  $\sim 0.3$  dBZ too HIGH (DVS SPROF as intermediate reference)
  - KPIX is  $\sim 1.6$  dBZ too LOW (DVS SPROF as intermediate reference)
  - STR SPROF is  $\sim 7.7$  dBZ too LOW (DVS SPROF as intermediate reference and KDAX, KMUX and KPIX as next intermediate references)

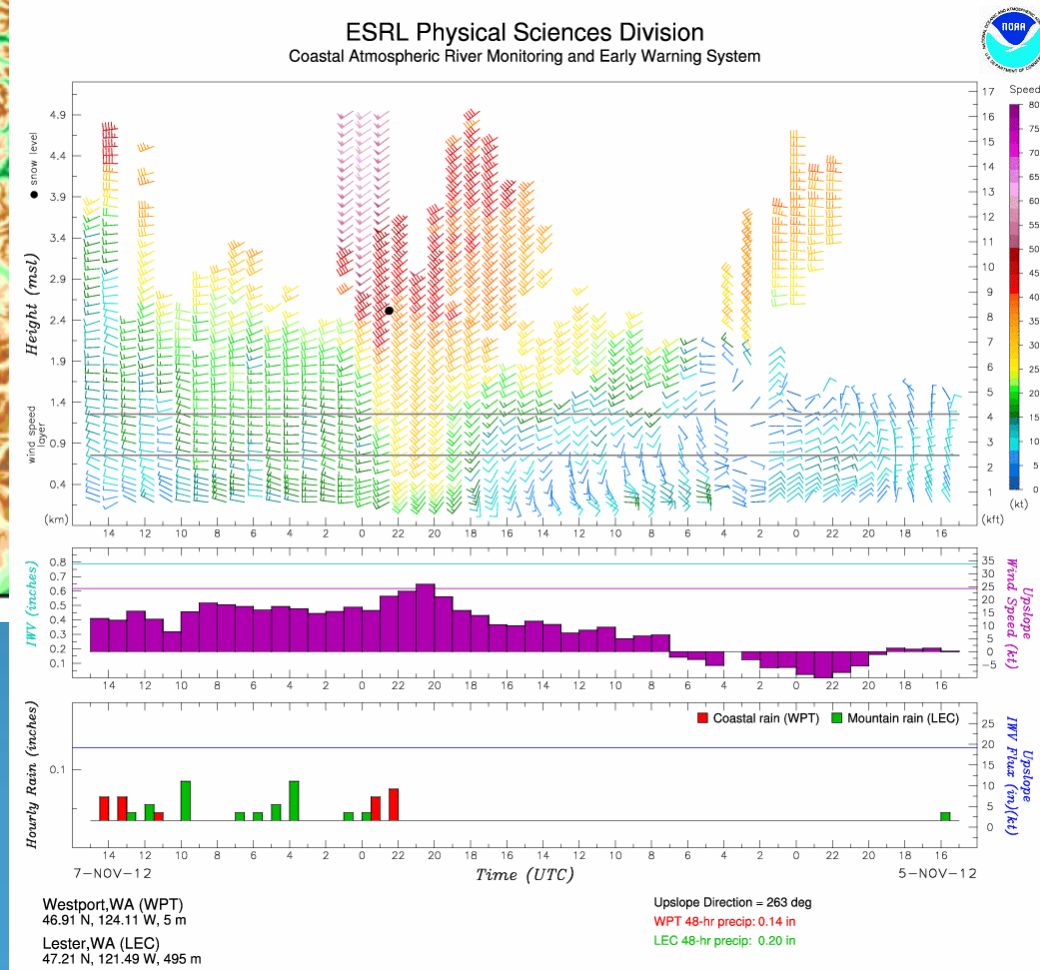


# Multi-wind Direction Display for Westport ARO

New water vapor flux displays  
requested by Seattle WFO



When Westport ARO S-PROF was interfering with the new coastal NEXRAD, we offered to move the ARO, but here's what the WCM from Seattle said: "The current site has some history now and its orientation to moisture moving into the interior of western Washington is excellent. We also would like to compare its output with the new radar data. So moving the ARO to another location....well, we'd really rather not."





# Western Region Spring 2012 Newsletter Highlights HMT

## Automated Atmospheric River Detection

### Application to Current GFS Forecast Fields

Forecast Initialized 20120326 at 12 Z

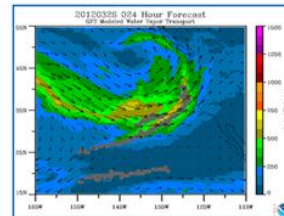
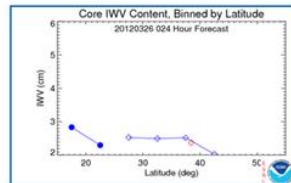
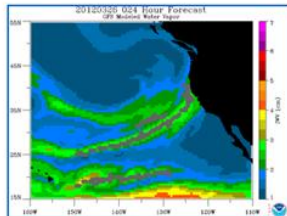
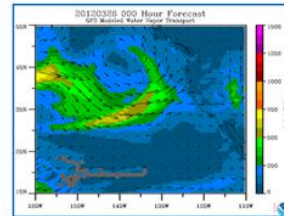
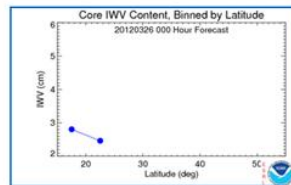
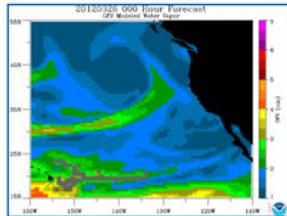
Valid Time

Overlay on Integrated Water Vapor

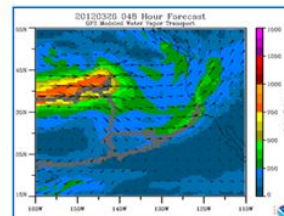
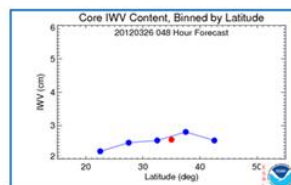
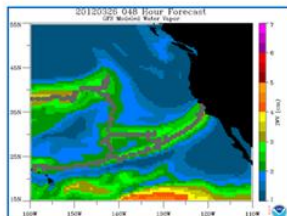
Average IWV in AR Core

Overlay on Integrated Vapor Transport

Analysis



1-Day Forecast Valid 12 Z on 20120327



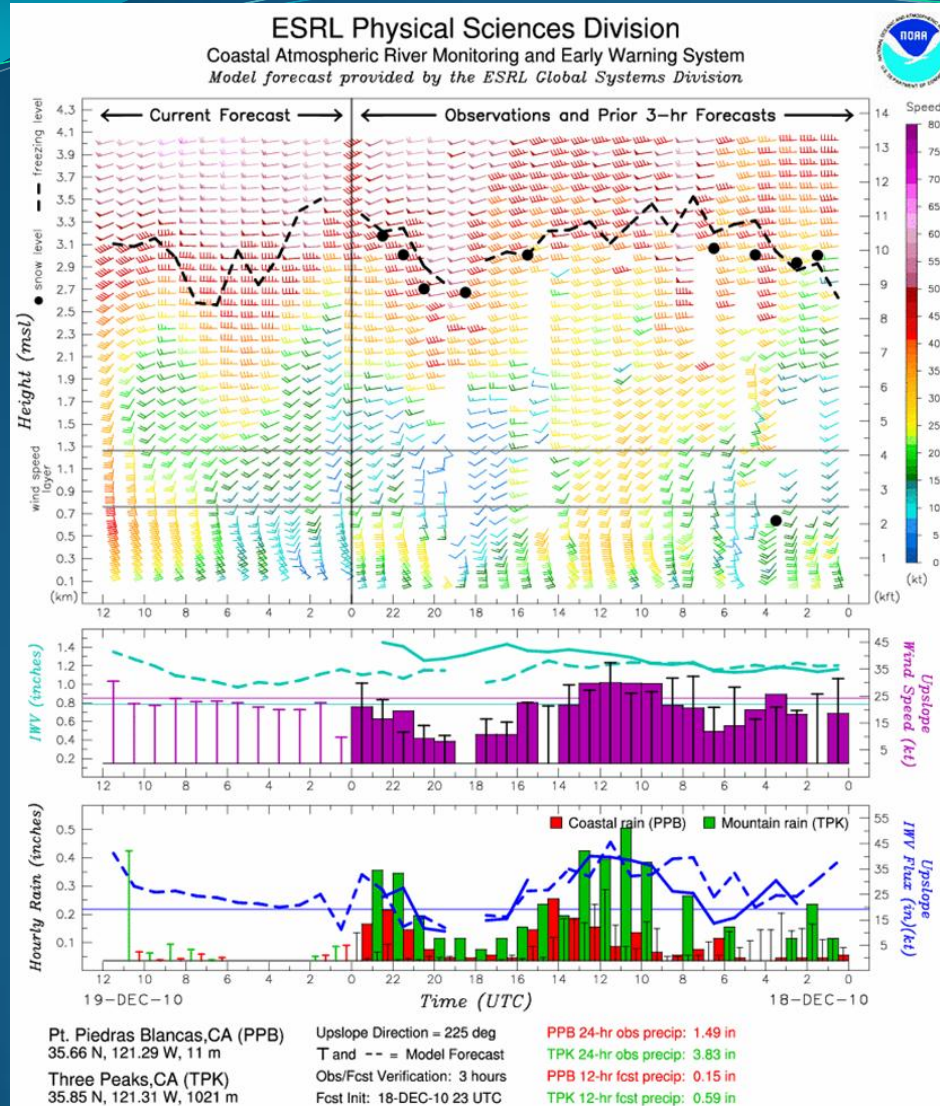
2-Day Forecast Valid 12 Z on 20120328

## New Atmospheric River tools from OAR PSD:

OAR Physical Science Division (PSD) has developed an experimental set of tools to identify atmospheric rivers (AR) and then combine these AR features with low level winds derived from the NCEP GFS to determine where the best cross-terrain flow will occur, and consequently, higher expected precipitation rates. The tool is call Atmospheric River Flux and can be found at:

[http://www.esrl.noaa.gov/psd/psd2/coastal/satres/data/html/ar\\_detect\\_gfs.html](http://www.esrl.noaa.gov/psd/psd2/coastal/satres/data/html/ar_detect_gfs.html)

# Western Region Spring 2012 Newsletter Highlights HMT



AR Observatory: A few sites have a number of sensors, which combined with the RUC, can be used to provide a more integrated view of the atmosphere. They are called AR Observatories and an example of the integrated model/data graphic is displayed below. All of the data can be found at: <http://www.esrl.noaa.gov/psd/data/obs/> - click on the sites with "vapor flux".

In addition, some new auto updating sites for monitoring snow level can be found below:  
<http://www.esrl.noaa.gov/psd/data/obs/autoupdate/Cazadero.html>  
<http://www.esrl.noaa.gov/psd/data/obs/autoupdate/SugarPine.html>  
<http://www.esrl.noaa.gov/psd/data/obs/autoupdate/SantaRosa.html>  
<http://www.esrl.noaa.gov/psd/data/obs/autoupdate/Westport.html>



# HMT 2012 Publications

- Matrosov, S. Y., 2012 (February): **Observations of Wintertime U.S. West Coast Precipitating Systems with W-Band Satellite Radar and Other Spaceborne Instruments**. *J. Hydrometeorol.*, **13**(1), 223-238.
- Minder, J. R., and D. E. Kingsmill, 2012: **Mesoscale variations of the atmospheric snow-line over the northern Sierra Nevada: multi-year statistics, case study, and mechanisms**. Submitted to *J. Atmos. Sci.*
- Mizukami, N., V. Koren, M. Smith, D. Kingsmill, Z. Zhang, B. Cosgrove and Z. Cui, 2012: **The impact of precipitation type discrimination on hydrologic simulation: Rain-snow partitioning derived from HMT-West radar-detected bright-band height versus surface temperature data**. Submitted to *J. Hydrometeor.*
- Moore, B. J., P. J. Neiman, F. M. Ralph, and F. E. Barthold, 2012 (February): **Physical processes associated with heavy flooding rainfall in Nashville, Tennessee, and Vicinity during 1-2 May 2010: The role of an atmospheric river and mesoscale convective systems**. *Mon. Wea. Rev.*, **140**(2), 358-378.
- White, A. B., B. Colman, G. M. Carter, F. Martin Ralph, R. S. Webb, D. G. Brandon, C. W. King, P. J. Neiman, D. J. Gottas, I. Jankov, K. F. Brill, Y. Zhu, K. Cook, H. E. Buehner, H. Opitz, D. W. Reynolds, L. J. Schick, 2012 (February): **NOAA's Rapid Response to the Howard A. Hanson Dam Flood Risk Management Crisis**. *Bull. Am. Meteorol. Soc.*, **93**(2), 189-207.
- Zhang, J., Y. Qi, D. Kingsmill, and K. Howard, 2012: **Radar-based Quantitative Precipitation Estimation for the cool season in complex terrain: Case studies from the NOAA Hydrometeorology Testbed**. *J. Hydrometeor.*, (In press)



# HMT-West Recent Awards



CIRES Annual Award for Snow-level Radar



NOAA Bronze Medal for the AR flux tool



NOAA Bronze Medal for NOAA's Rapid Response to the HHD crisis

# HMT-West: FY13 Plans

- Continued operation and maintenance of HMT precipitation and soil moisture networks in the American, Russian, and Babocomari River Basins
- Continuation of the HMT Legacy observing, modeling, display, and decision support projects
  - New 9km mesoscale numerical model ensemble over North America
  - Install four coastal AROs (FY13-14)
  - Install three additional snow-level radars
  - Finish installing soil-moisture network
- Establish a 2<sup>nd</sup> five-year MOU with CA DWR
  - O&M for 1<sup>st</sup> MOU observing, modeling, and display networks
  - Network optimization in key watersheds
  - Decision support tools
- Develop MOU with SFPUC
- Develop version(s) of AR flux tool with rapid update operational model(s)
- Provide shef-encoding for soil moisture and integrated water vapor and send these data to NWS Western Region
- Develop forecast verification overlays in Google Maps
- Conduct outreach and training to maximize use of HMT data in forecast operations and possibly to expand network to other regions